

## CLAIMS

What is claimed is:

- 1     1.     A method of discovering a network path that satisfies a quality of service (QoS)  
2           requirement, the method comprising the computer-implemented steps of:  
3           receiving, at a first router, a first data packet that indicates a destination and said QoS  
4           requirement;  
5           updating said first data packet to indicate an identity of said first router;  
6           determining whether a least-delay path from said first router to said destination satisfies  
7           said QoS requirement;  
8           determining whether said first data packet has visited any router in said least-delay path  
9           other than said first router;  
10          if said least-delay path satisfies said QoS requirement and said first data packet has not  
11           visited any router in said least-delay path other than said first router, then sending  
12           said first data packet to a second router in said least-delay path; and  
13          receiving, at said first router, a second data packet that indicates a path taken by said first  
14           data packet to said destination.
- 1     2.     The method of Claim 1, wherein said first router has links, and further comprising:  
2           if said least-delay path does not satisfy said QoS requirement, then performing steps  
3           comprising:  
4           determining one or more of said first router's links that satisfy said QoS  
5           requirement; and  
6           sending a copy of said first data packet through said one or more of said first  
7           router's links that satisfy said QoS requirement.
- 1     3.     The method of Claim 1, wherein said first router has links, and further comprising:  
2           if said first data packet has visited a router in said least-delay path other than said first  
3           router, then performing steps comprising:  
4           determining one or more of said first router's links that satisfy said QoS  
5           requirement; and

6 sending a copy of said first data packet through said one or more of said first  
7 router's links that satisfy said QoS requirement.

1 4. The method of Claim 1, further comprising:  
2 in response to receiving said first data packet, updating a table to indicate that said first  
3 router has received a copy of said first data packet.

1 5. A method of discovering a network path that satisfies a quality of service (QoS)  
2 requirement, the method comprising the computer-implemented steps of:  
3 receiving, at a first router, a data packet that indicates a destination and said QoS  
4 requirement;  
5 determining whether said data packet indicates that a path to said destination has been  
6 found;  
7 determining whether a least-delay path from said first router to said destination satisfies  
8 said QoS requirement;  
9 if said data packet indicates that a path to said destination has been found, and if said  
10 least-delay path from said first router to said destination does not satisfy said QoS  
11 requirement, then eliminating said data packet; and  
12 if said data packet does not indicate that a path to said destination has been found, and if  
13 said least-delay path from said first router to said destination satisfies said QoS  
14 requirement, then performing steps comprising:  
15 updating said data packet to indicate that a path to said destination has been  
16 found; and  
17 sending said data packet through said link that leads to said second router on said  
18 least-delay path.

1 6. A method of discovering a network path that satisfies a quality of service (QoS)  
2 requirement, the method comprising the computer-implemented steps of:  
3 receiving, at a first router that has links, a data packet that indicates a destination and said  
4 QoS requirement;  
5 determining whether said first router previously has received a copy of said data packet;  
6 if said first router previously has received a copy of said data packet, then eliminating  
7 said data packet; and

8           if said first router previously has not received a copy of said data packet, then performing  
9           steps comprising:  
10          updating a table to indicate that said first router has received a copy of said data  
11          packet;  
12          determining whether said data packet indicates that a path to said destination has  
13          been found;  
14          determining whether a least-delay path from said first router to said destination  
15          satisfies said QoS requirement;  
16          if said data packet indicates that a path to said destination has been found, then  
17          performing steps comprising:  
18                  if said least-delay path from said first router to said destination does not  
19                  satisfy said QoS requirement, then eliminating said data packet;  
20                  and  
21                  if said least-delay path from said first router to said destination satisfies  
22                  said QoS requirement, then sending said data packet through a link  
23                  that leads to a second router on said least-delay path; and  
24          if said data packet does not indicate that a path to said destination has been found,  
25          then performing steps comprising:  
26                  determining one or more of said first router's links that satisfy said QoS  
27                  requirement;  
28                  if said least-delay path from said first router to said destination does not  
29                  satisfy said QoS requirement, then sending a copy of said data  
30                  packet through said one or more of said first router's links that  
31                  satisfy said QoS requirement; and  
32                  if said least-delay path from said first router to said destination satisfies  
33                  said QoS requirement, then performing steps comprising:  
34                          determining whether said data packet has visited any router in said  
35                          least-delay path other than said first router;  
36                          if said data packet has visited a router in said least-delay path other  
37                          than said first router, then sending a copy of said data

38 packet through said one or more of said first router's links  
39 that satisfy said QoS requirement; and  
40 if said data packet has not visited any router in said least-delay  
41 path other than said first router, then performing steps  
42 comprising:  
43 updating said data packet to indicate that a path to said  
44 destination has been found; and  
45 sending said data packet through said link that leads to said  
46 second router on said least-delay path.

1 7. A method of discovering a least-cost network path, the method comprising the computer-  
2 implemented steps of:  
3 receiving, at a first router, a first data packet that indicates a destination;  
4 updating said first data packet to indicate an identity of said first router;  
5 determining whether said first data packet has visited any router in a least-cost path from  
6 said first router to said destination, not including said first router;  
7 if said first data packet has not visited any router in said least-cost path other than said  
8 first router, then sending said first data packet to a second router in said least-cost  
9 path;  
10 if said first data packet has visited a router in said least-cost path other than said first  
11 router, then sending said first data packet to a third router in a first least-delay  
12 path from said first router to said destination; and  
13 receiving, at said first router, a second data packet that indicates a path taken by said first  
14 data packet to said destination;  
15 wherein said least-cost path differs from said first least-delay path.

1 8. The method of Claim 7, further comprising:  
2 receiving, at said second router, said first data packet;  
3 determining whether a second least-delay path from said second router to said destination  
4 satisfies a delay requirement indicated by said first data packet;  
5 if said second least-delay path does not satisfy said delay requirement, then performing  
6 steps comprising:

7 updating said first data packet to indicate a wrong way; and  
8 sending said first data packet to said first router.

1 9. The method of Claim 8, further comprising:  
2 receiving, at said first router, said first data packet;  
3 determining whether said first data packet indicates a wrong way;  
4 if said first data packet indicates a wrong way, then performing steps comprising:  
5 updating said first data packet to not indicate a wrong way; and  
6 sending said first data packet to said third router.

1 10. A computer-readable medium carrying one or more sequences of instructions for  
2 discovering a network path that satisfies a quality of service (QoS) requirement, which  
3 instructions, when executed by one or more processors, cause the one or more processors  
4 to carry out the steps of:  
5 receiving, at a first router, a first data packet that indicates a destination and said QoS  
6 requirement;  
7 updating said first data packet to indicate an identity of said first router;  
8 determining whether a least-delay path from said first router to said destination satisfies  
9 said QoS requirement;  
10 determining whether said first data packet has visited any router in said least-delay path  
11 other than said first router;  
12 if said least-delay path satisfies said QoS requirement and said first data packet has not  
13 visited any router in said least-delay path other than said first router, then sending  
14 said first data packet to a second router in said least-delay path; and  
15 receiving, at said first router, a second data packet that indicates a path taken by said first  
16 data packet to said destination.

1 11. The computer-readable medium of Claim 10, wherein said first router has links, and  
2 wherein said instructions, when executed by the one or more processors, cause the one or  
3 more processors to carry out the steps of:  
4 if said least-delay path does not satisfy said QoS requirement, then performing steps  
5 comprising:

6           determining one or more of said first router's links that satisfy said QoS  
7           requirement; and  
8           sending a copy of said first data packet through said one or more of said first  
9           router's links that satisfy said QoS requirement.

1   12.    The computer-readable medium of Claim 10, wherein said first router has links, and  
2           wherein said instructions, when executed by the one or more processors, cause the one or  
3           more processors to carry out the steps of:  
4           if said first data packet has visited a router in said least-delay path other than said first  
5           router, then performing steps comprising:  
6           determining one or more of said first router's links that satisfy said QoS  
7           requirement; and  
8           sending a copy of said first data packet through said one or more of said first  
9           router's links that satisfy said QoS requirement.

1   13.    The computer-readable medium of Claim 10, wherein said instructions, when executed  
2           by the one or more processors, cause the one or more processors to carry out the steps of:  
3           in response to receiving said first data packet, updating a table to indicate that said first  
4           router has received a copy of said first data packet.

1   14.    An apparatus for discovering a network path that satisfies a quality of service (QoS)  
2           requirement, comprising:  
3           means for receiving, at a first router, a first data packet that indicates a destination and  
4           said QoS requirement;  
5           means for updating said first data packet to indicate an identity of said first router;  
6           means for determining whether a least-delay path from said first router to said destination  
7           satisfies said QoS requirement;  
8           means for determining whether said first data packet has visited any router in said least-  
9           delay path other than said first router;  
10          means for sending said first data packet to a second router in said least-delay path if said  
11           least-delay path satisfies said QoS requirement and said first data packet has not  
12           visited any router in said least-delay path other than said first router; and

means for receiving, at said first router, a second data packet that indicates a path taken by said first data packet to said destination.

15. The apparatus of Claim 14, wherein said first router has links, and further comprising:  
means for determining one or more of said first router's links that satisfy said QoS requirement if said least-delay path does not satisfy said QoS requirement; and  
means for sending a copy of said first data packet through said one or more of said first router's links that satisfy said QoS requirement if said least-delay path does not satisfy said QoS requirement.

16. The apparatus of Claim 14, wherein said first router has links, and further comprising:  
means for determining one or more of said first router's links that satisfy said QoS requirement if said first data packet has visited a router in said least-delay path other than said first router; and  
means for sending a copy of said first data packet through said one or more of said first router's links that satisfy said QoS requirement if said first data packet has visited a router in said least-delay path other than said first router.

17. The apparatus of Claim 14, further comprising:  
means for updating, in response to receiving said first data packet, a table to indicate that said first router has received a copy of said first data packet.

18. An apparatus for discovering a network path that satisfies a quality of service (QoS) requirement, comprising:  
a network interface that is coupled to a data network for receiving one or more packet flows therefrom;  
a processor;  
one or more stored sequences of instructions which, when executed by the processor, cause the processor to carry out the steps of:  
receiving, at said apparatus, a first data packet that indicates a destination and said QoS requirement;  
updating said first data packet to indicate an identity of said apparatus;  
determining whether a least-delay path from said apparatus to said destination satisfies said QoS requirement;

13 determining whether said first data packet has visited any router in said least-  
14 delay path other than said apparatus;  
15 if said least-delay path satisfies said QoS requirement and said first data packet  
16 has not visited any router in said least-delay path other than said  
17 apparatus, then sending said first data packet to a router in said least-delay  
18 path; and  
19 receiving, at said apparatus, a second data packet that indicates a path taken by  
20 said first data packet to said destination.

1 19. The apparatus of Claim 18, wherein said apparatus has links, and wherein said  
2 instructions, when executed by the processor, cause the processor to carry out the steps  
3 of:  
4 if said least-delay path does not satisfy said QoS requirement, then performing steps  
5 comprising:  
6 determining one or more of said apparatus' links that satisfy said QoS  
7 requirement; and  
8 sending a copy of said first data packet through said one or more of said  
9 apparatus' links that satisfy said QoS requirement.

1 20. The apparatus of Claim 18, wherein said apparatus has links, and wherein said  
2 instructions, when executed by the processor, cause the processor to carry out the steps  
3 of:  
4 if said first data packet has visited a router in said least-delay path other than said  
5 apparatus, then performing steps comprising:  
6 determining one or more of said apparatus' links that satisfy said QoS  
7 requirement; and  
8 sending a copy of said first data packet through said one or more of said  
9 apparatus' links that satisfy said QoS requirement.

1 21. The apparatus of Claim 18, wherein said instructions, when executed by the processor,  
2 cause the processor to carry out the steps of:  
3 in response to receiving said first data packet, updating a table to indicate that said  
4 apparatus has received a copy of said first data packet.